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**SOME CLINICAL NOTES
ON
TUBERCULOUS ARTHRITIS IN
THE YOUNG**

**BY
ROBERT JONES**

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LECTURER ON ORTHOPEDIC SURGERY AT LIVERPOOL UNIVERSITY

**REPRINTED FROM THE "EDINBURGH MEDICAL JOURNAL,"
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MR. PRESIDENT AND GENTLEMEN,—I have chosen the subject of tuberculous joints, because from my earliest days I was associated with the late Hugh Owen Thomas in his strenuous advocacy of conservatism in their treatment, and because there may be many differences between my own practice and that of the eminent surgeons in your own city. In an address of this kind, necessarily disjointed and scrappy, I do not intend to present elaborate statistics, nor indeed to do more than touch, and that lightly, upon certain features in the diagnosis and treatment of tuberculous arthritis in the young. I emphasise the *young*, because tubercle in the *adult* is infinitely more serious, runs a much more malignant course, and often requires more heroic methods.

Mr. Thomas's treatment was based on a theory of mechanical and physiological rest. Mechanical rest he attained by carefully attaching the joint to a rigid iron frame; physiological rest by allowing free circulation through the joint, hampered as little as possible by circular compression. He argued that rest of the joint was hindered by extension, and that, where traction appeared to benefit, it was in virtue of the fact that traction must needs be accompanied by a certain degree of fixation. Friction, as represented in his time by passive movements, he thought a much more dangerous proceeding than mere pressure of one joint surface upon another. In fifteen years, to my own knowledge, he never performed an excision of a joint, although very many hundreds of cases passed through his hands, and his percentage of abscess formation was unusually low. In those early days I had exceptional opportunities of watching the progress of his cases, and I am very sure when I say that neither before, nor by any methods since, have I seen anything approaching the consistently good results which he obtained. I became a very early convert to his teachings, and since he died, fourteen years ago, I have found no need to modify essentially the doctrines which he taught.

Without going into details as to diagnosis, I desire to draw attention to two symptoms which, if properly interpreted, are of considerable value. I allude to rigidity and deformity. One of the first and more reliable accompaniments of arthritis is rigidity. It generally precedes pain, and is earlier ascertained than muscular shrinkage. There are certain points in relation to this rigidity which either give to it, or deny to it, clinical value in relation to

¹ Read by invitation of the Edinburgh Medico-Chirurgical Society.

the diagnosis of arthritis. In arthritis, no matter what the joint, the rigidity affects it in all directions—flexion, extension, abduction, adduction, and rotation. In a suspected joint, if there be no limitation of movement, there is no arthritis. The exceptions to this rule are so rare that I have come to treat it as an axiom. In early cases the rigidity must be examined for without an anæsthetic; as it is primarily due to muscular action, later contractures or muscle shortening will follow as secondary effects, but by then a diagnosis will be obvious. As an illustration we may take the case of the spine and the knee. A girl complains of pain in her back in the dorso-lumbar region. The surgeon asks her to flex, extend, and laterally move her spine, which she does freely. In such a case one can safely exclude a spondylitis. Another girl may be very tender over the spine, have great difficulty in flexing her column, but she can hyper-extend it with ease, and here again we may place to one side our suspicion of tubercle. In a third case the spine is rigid in ALL directions, and this symptom is quite in accord with an inflammatory vertebral lesion. Rigidity is more reliable than any other single symptom or any single group of symptoms. Pain, as evidenced by pressure on the vertebral spines, is hopelessly unreliable, and if present is an argument against rather than in favour of a Pott's lesion. In early spondylitis, where the disease is confined to the front of the vertebral bodies, it is unreasonable to expect pain from pressure upon the spines.

Let us again take the knee, by way of illustrating the symptom of rigidity. A youth complains of tenderness and swelling of a joint which he is able fully to *extend* but cannot fully *flex*. We may be sure he is not the victim of tuberculous arthritis. If, however, both as to flexion and extension, the knee has a diminished range of movement, powerful confirmation of organic lesion is vouchsafed. A joint requiring forcible manipulation is very often a tender joint, sometimes swollen, with certain limitations in movement. It is tender and swollen because of the constant irritation produced by adhesions being partially stretched. Such cases are the bone-setter's harvest, and occur not infrequently in the young. In cases of prolonged synovial effusion in joints, where tuberculous infection has occurred, the absence of rigidity may deceive, but such effusions are rare in children. I would desire to impress upon you, gentlemen, that in arthritis the movements of a joint are limited not in one, or some, but in all directions. Upon the full appreciation of this fact much may depend.

In the very early stages of hip disease, lack of normal extension and rotation are more noticeable than are restrictions to flexion and the lateral movements; but a careful comparison between the movements possible at the two hip-joints will render the defect apparent to one who has become at all familiar with this peculiar symptom. To describe the sensation is difficult;

it is better learned from the patient than from a surgeon. The restriction which involuntary muscular spasm gives to attempted passive motion is not the slowly elastic yielding of voluntary muscular opposition, nor the sudden dead stop of ligamentous or fibrous adhesions; nevertheless it is a sudden and positive stop, which, once felt, will always be recognised.

For simplicity of examination, we are accustomed to test for flexion both in hip and knee, as this restriction is more obvious

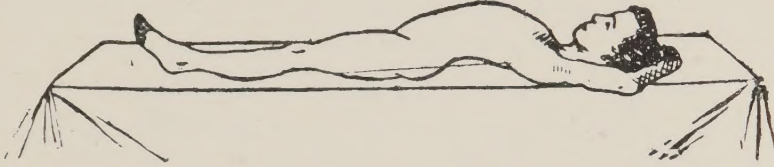


FIG. 1.—Shows lordosis present in hip disease

than any other, and is the most directly disabling. To detect flexion in the hip considerable care is needed, more especially in early cases and in the very young. The Thomas flexion test is founded upon our inability to extend an inflamed hip without producing lordosis (Fig. 1). By lifting the knee of the sound limb

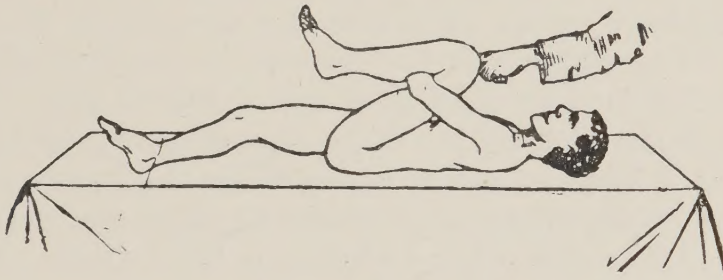


FIG. 2.—Method of flexing normal thigh on pelvis

until it touches the chest, the pelvis is fixed and the spine is straightened (Figs. 2 and 2A). If there be flexion deformity, the

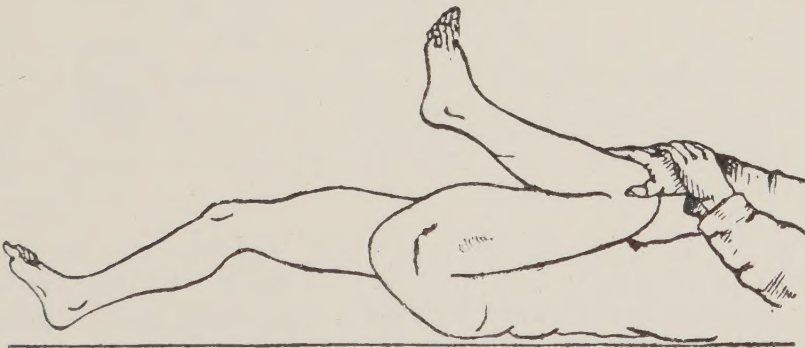


FIG. 2A.—Faulty method of examining by lifting pelvis upon spine

patient is unable to extend the thigh on the diseased side, and it remains at an angle (Fig. 3). If disease be absent, the patient can voluntarily extend his limb. Some of us have not observed that if we take any healthy subject, and lay him flat upon a table, we can easily pass our hand under the lumbar vertebræ; but if we

ask the subject to touch the table with his back, he is able to obliterate the hollow without lifting his limb. This is a ready guide for the detection of deformity. In no case of hip disease is the patient able to straighten his spine, until art has stepped in and corrected the flexion deformity (Fig. 3).



FIG. 3.—Inability to straighten diseased limb whilst normal hip is flexed

The application of the flexion test in the case of an infant requires considerable delicacy. A child 2 or 3 years old is brought for examination. A vague history of irritability may be alone complained of, or pain may be occasioned when the child is washed. The surgeon is to find out, in the first place, whether there is an inflamed joint, and, if so, on which side. The child is gently put upon the table, while the surgeon, without exciting alarm, holds a knee in either hand. The thighs are slowly flexed towards the chest, when it is observed that one easily yields to full flexion, while the other becomes a little rigid. The stiff hip is then gently allowed to fall, while the sound one is fully flexed

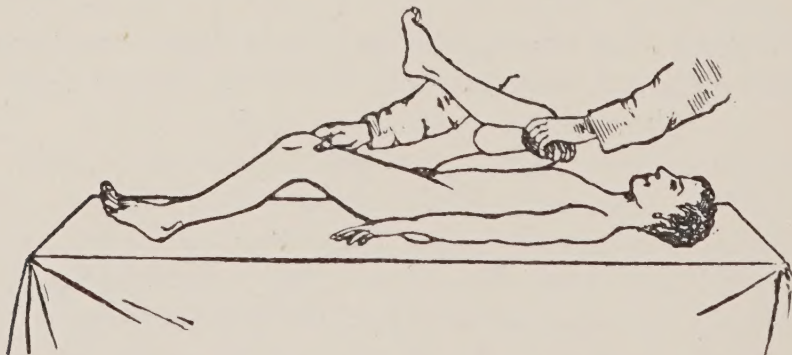


FIG. 4.—Surgeon gently flexes both limbs, and, finding the left more rigid, continues only to flex the right, while he allows the left to fall. Useful in the case of small children who cannot say on which side the disease is

(Fig. 4). It will then be perceived that the diseased limb remains at an angle and cannot voluntarily be fully extended. Stress must be laid upon the necessity of not startling the child, and of not using the slightest force; while care must be taken, first, not to flex the pelvis upon the spine, and, secondly, to conduct the examination upon an even, flat surface. Although this test is not

absolutely diagnostic, still, if the hip be complained of, and pelvic, vertebral, or sacro-iliac disease be negatived, one can fairly infer the presence of arthritis.

The arthritis deformities are almost constant in character, and are practically all avoidable. In late hip disease they consist of flexion, internal rotation, shortening, and adduction; in the knee, flexion, subluxation, and external rotation of tibia; in the back, a kyphos sometimes preceded by a lateral deviation; in the shoulder, elevation of girdle, adduction; and, in the later stages, what I have described as a pathological subcoracoid displacement of the humerus. The spinal lateral deviation is very important clinically, and I have seen serious mistakes made by excellent surgeons who have mistaken this lateral deviation accompanying Pott's disease for a symptom of scoliosis. In early Pott's disease rigidity would be present; in lateral curvature rigidity is only present in the later stages where rotatory changes have occurred. To illustrate the value of the early recognition of deformities of the shoulder, to which but scant reference is made in our text-books, I submit to you this incident.

A man from a northern country town brought his son, a youth of 19, to consult me about his shoulder, which it was said had been dislocated for over two years. The boy fell from the box of a brougham upon his shoulder. It was painful and swollen. The family doctor prescribed rest and lotions, and, after a few weeks' attendance, left his patient with a few general instructions. Time passed, the joint was painful, and in due course he was taken to the Metropolis, where dislocation was diagnosed, to the discredit and humiliation of the local practitioner, who fully believed he had made a grave initial error. I was soon able, however, to convince the father that the case was one of pathological displacement, that the local practitioner against whom he raved was guiltless, and that attempts at reduction would be of no avail. How important, therefore, both for the sake of the patient and the previous attendant, that the differences and the similarities between the two conditions should be noted. The muscular shrinkage was more marked, the head of the bone less displaced, and the coracoid more prominent in the pathological shoulder than would have been the case in an old injury. In a dislocated shoulder the disability is greatest in the beginning, and as weeks pass by an excellent range of movement results. In the pathological variety the precise converse obtains, and an ankylosed shoulder generally results.

If we trace a neglected case of coxitis from health to disease, and back again, we find that involuntary spasm of the flexors of the thigh becomes more and more pronounced, until at length the joint mobility has gone. The typical deformities appear, and the position of the limb is such that, when the patient attempts to walk, the body-weight is carried on the diseased side for comparatively

only a brief period at each step, and anything like prolonged weight-bearing while standing at rest is impossible. Later, the joint may become so painful that weight-bearing and even vibration are not tolerated, and the patient takes to bed. The leg assumes the position of greatest comfort, and muscular spasm protects and locks the joint. As the patient falls asleep the muscular spasm relaxes, motion takes place, injury is inflicted, the child screams, and the muscles are again on guard. Long continued malposition results in structural shortening of the tissues of the flexure side, and immobilisation is maintained with but little muscular effort. When the joint has been free from motion and weight-bearing for a time, the tenderness passes off, the patient is ultimately enabled to place full weight upon the affected side; nevertheless spasm and rigidity are maintained for a long time. When the disease has terminated, the spasm disappears, but the structural shortening of the soft part remains and yields gradually to use during the subsequent months and years. The result of this cure by the natural process is an extremely deformed limb, with impaired movements. The defects appear to be due to the prolonged course of the disease, which hinders the growth of the limb, and renders more rigid the shortened muscles, and to the position of deformity in which the leg rests while structural shortening takes place.

The means which art adopts, therefore, are to protect from deformity, or, if deformity has appeared, to correct it, and thus to rob the muscular contraction of its power for evil; to immobilise the joint, and thus relieve the muscles from spasm and then from contracture; to relieve pain and prevent the bone destruction due to both attrition and pressure, and to relieve the joint from weight-bearing. The all-essential treatment therefore is rest.

For coxitis in very young children I do not use a single but a double splint. It immobilises better, it is easier to apply, easier maintained in position, and simplifies nursing. In this frame the child is kept until all signs of disease are gone, as evidenced by tests to which I will refer. Sunlight and fresh air are desiderata of incalculable value, and the child lives in the open air. Such cases seen early go on generally without complication, many recovering with movable joints, remaining in splints often for two years, and rarely exhibit a flexion deformity of more than 10° . The circulation through the hip must in no way be hampered by the appliance. Leverage pressure is obtained above, by the body wings of the splint. In early cases I never employ extension, and if immobility be well secured, the so-called night-jerks will hardly ever trouble. Pain will be felt at first, but it lasts only during the correction of the flexion, which in an early case occurs almost at once.

A more difficult class to treat is the child whose disease is

more advanced, and whose deformity is considerable. This is a common variety seen at my clinic or my rooms. The femoral head is displaced upwards, adduction is present, with a shortening of from 1 to 4 in. If the general condition of the child be satisfactory, I have an anæsthetic administered, and set myself to correct the deformity. This may require some force, steadily, not jerkily, applied, and in children never requires the aid of special machinery. A direct pull by means of a thick skein of wool, and counter-extension by a sheet between the limbs on the sound side, division of the adductors if they are tense, will generally equalise so-called practical or apparent length of limb. I prefer to correct the deformity at one sitting, rather than irritate the joint on many occasions by lesser pulls. The correction consists in overcoming flexion and adduction and lowering the pelvis on the diseased side. Once in the abduction frame (Fig. 5) the limb is kept at absolute rest, and the constant muscular pull upon the femoral head, as evidenced by ever-increasing deformity, is overcome. I know that to many surgeons this teaching will appear heretical, but I can truly say, speaking from an experience of many hundreds of such cases, that dissemination of tubercle does not attack such cases any more often than it does those left alone.

Where deformity is present to a lesser extent, it is sufficient to place the patient on an abduction frame. The splint is very simple, and effectually combats any adduction of the limb (Fig. 5).

Before leaving the subject of deformities, may I say that one of the common errors committed by the surgeons called upon to examine a hip-joint is to discard the use of a measuring tape; yet, for a correct record, this homely article is all-essential. My Transatlantic colleague, Dr. Ridlon, united with me some years ago in emphasising the necessity of determining the nature and degree of the deformities accompanying tuberculous disease in the

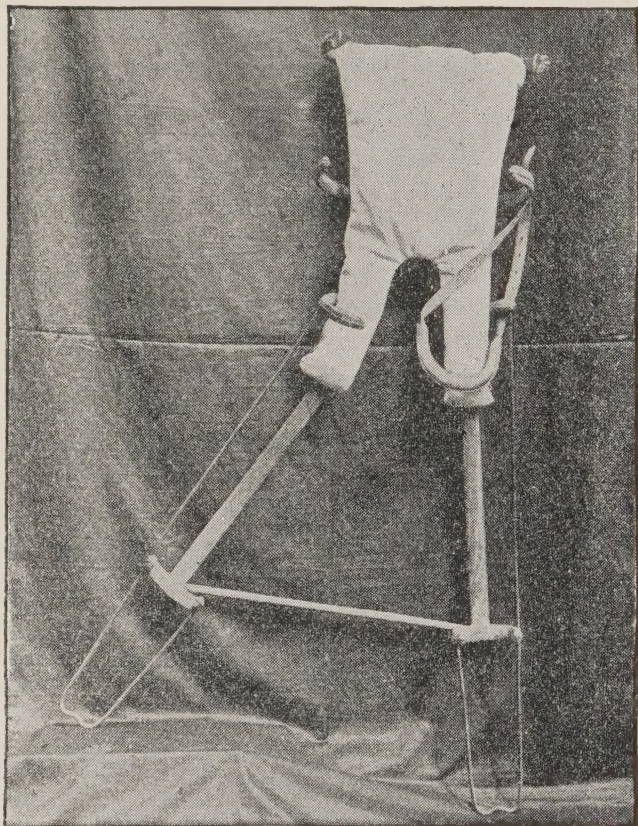


FIG. 5.—Abduction splint

various joints, and I venture as regards the hip to reiterate the advice we gave.

Outward rotation or eversion of the limb is associated with abduction, and inward rotation with adduction. The cause of these malpositions has not been absolutely determined, but it would seem probable that the patient assumes the attitude of greatest comfort, whether lying, sitting, or standing, and this strongly influences the deformity in the early stages of the affection. Later, the malposition is determined by the unbalanced force existing between the opposing groups of muscles in their effort to immobilise the joint, or between the muscular groups on the one hand and the mechanical device employed in the treatment of the disease on the other hand.

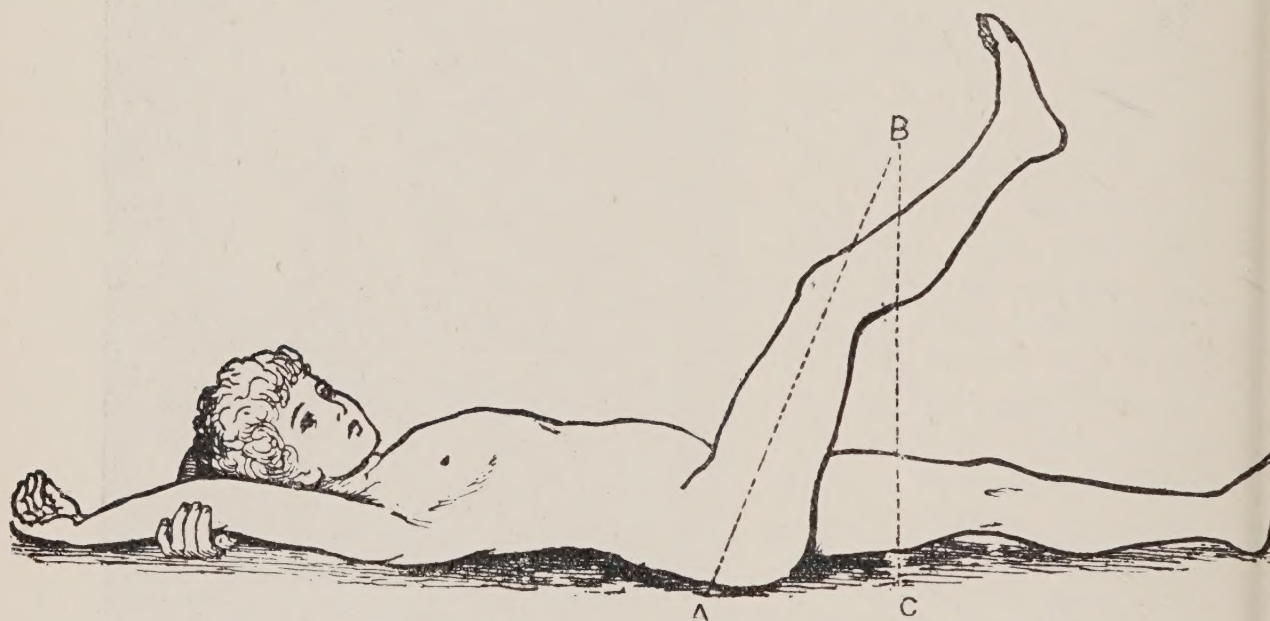


FIG. 6.—Method of estimating flexion angle

Shortening may be either actual or practical. Actual shortening is due either to arrested growth, to actual bone destruction, or to partial or complete subluxation. None of these conditions is found early in the disease, but an accurate record should be kept, for in this way the prognosis as to the ultimate length of the limb can best be judged. Practical or false shortening is due to adduction or flexion, or both. It is from the relation of the actual to the practical shortening that we conveniently compute the degree of adduction.

The extent of flexion caused by the deformity may be estimated in the following manner. Whilst the patient is on his back, on a table, the surgeon lifts the diseased limb until all lordosis is corrected, and the pelvis is in a normal position (Fig. 6). He applies a tape-measure along the outer border of the limb in a line with the femur, commencing at a point where it diverges from the table. He measures the length to any point, and the

length of a perpendicular from that point down to the table.

Lovett's Table

		Distance between Anterior Superior Spines in Inches																	
		3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11	12	13
Difference in Inches between Real and Apparent Shortening .	1	5	4	4	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1
	1¼	10	8	7	6	5	5	4	4	4	4	4	4	4	3	3	3	3	2
	1½	14	12	11	10	8	8	7	7	6	6	5	5	5	4	4	4	3	3
	1¾	19	17	14	13	11	10	9	9	8	7	7	7	6	6	6	5	5	4
	2	25	21	18	16	14	13	12	11	10	9	9	8	8	7	7	7	6	6
	2¼	30	25	22	19	17	15	14	13	12	12	11	10	10	9	9	8	7	7
	2½	36	30	26	23	20	18	17	15	14	13	13	12	11	10	10	9	8	8
	2¾	42	35	30	26	23	21	19	18	16	15	14	14	13	12	12	10	10	9
	3	—	40	34	30	26	24	21	20	19	17	16	15	14	14	13	12	11	10
	3¼	—	—	39	34	29	27	24	22	21	19	18	17	16	15	14	13	12	11
	3½	—	—	—	38	32	29	27	25	23	21	20	19	18	17	16	14	13	12
	3¾	—	—	—	42	35	32	29	27	25	23	22	21	19	18	18	16	14	13
	4	—	—	—	—	39	36	32	30	27	26	25	22	21	20	19	17	15	14
	4¼	—	—	—	—	40	35	33	30	28	26	24	23	22	21	19	17	16	16
4½	—	—	—	—	—	38	35	32	30	28	26	25	23	22	20	18	17	17	
4¾	—	—	—	—	—	42	38	35	32	30	28	26	25	23	21	19	18	18	

The decimal fraction obtained by dividing the length of the perpendicular by the length measured along the limb will give what mathematicians call the sine of the angle. By consulting a book of mathematical tables the angle is found. G. L. Kingsley measures a constant length of 24 in. along the thigh, and then publishes a table showing the angle corresponding to the length of each perpendicular. The diagram (Fig. 6) explains the direction of the lines for the purpose of estimating the flexion angle.

Kingsley's Table

In.	Deg.	In.	Deg.	In.	Deg.	In.	Deg.
0.5	1	6.5	16	12.5	31	18.5	50
1.0	2	7.0	17	13.0	33	19.0	52
1.5	3	7.5	19	13.5	34	19.5	54
2.0	4	8.0	20	14.0	36	20.0	56
2.5	6	8.5	21	14.5	37	20.5	58
3.0	7	9.0	22	15.0	39	21.0	60
3.5	9	9.5	24	15.5	40	21.5	63
4.0	10	10.0	25	16.0	42	22.0	67
4.5	11	10.5	27	16.5	43	22.5	70
5.0	12	11.0	28	17.0	45	23.0	75
5.5	14	11.5	29	17.5	47	23.5	80
6.0	15	12.0	30	18.0	48	24.0	90

To measure for abduction and adduction, the method of R. W. Lovett of Boston is the readiest and best. The patient is made to lie straight with the legs parallel. The surgeon now

measures for real and for false shortening. Real shortening is found by measuring from the anterior superior spine of the ilium to the inner malleolus on either side, and comparing them. False or practical shortening is estimated by comparing the distance between the umbilicus and inner malleolus on either side. Having obtained this information, we turn to Lovett's table. If the line which represents the amount of difference in inches between the real and apparent shortening is followed until it intersects the line which represents the pelvic breadth, we find the angle of deformity. If the practical shortening be greater than the real shortening, the diseased leg is adducted; if less than the real shortening, it is abducted. An example will serve to illustrate the method of using the table, *e.g.* length (from anterior superior spine) of right leg, 23 in.; left leg, $22\frac{1}{2}$ in.; length (from umbilicus) of right leg, 25 in.; left leg, 22 in.; real shortening, $\frac{1}{2}$ in.; difference between real and practical shortening, $2\frac{1}{2}$ in.; pelvic measurement, 7 in. If we follow the line for $2\frac{1}{2}$ in. until it intersects the line for pelvic breadth of 7 in., we find 21° to be the angle of deformity; as the practical shortening is greater than the real, it is 21° of abduction of the left leg.

The importance of an accurate record of the angle of flexion and adduction or abduction is of the greatest importance. Upon it, and upon it alone at times, depends the diagnosis of the disease; and upon it depends the diagnosis of a cure in all cases resulting in ankylosis. A joint in which the angle of deformity is changing is capable, under proper treatment, of gaining a still greater degree of usefulness. In a case destined to result in ankylosis a cure is not effected until the angle of the deformity ceases to change.

Should abscesses present, what are we to do? In days gone by I used to open up and drain nearly every abscess cavity I could find; this quite irrespectively of any symptoms that were present. A comparison of my operated-upon cases and those treated by more expectant methods convinced me of the value of leaving certain types of tuberculous collections alone as long as possible. I now leave these abscesses alone if they give rise to no symptoms. Generally speaking, they are harmless. They are only dangerous if infected from without or from within. It is a mistake to attach the clinical importance to a tuberculous abscess that we do to a collection of pus. The tuberculous bacillus is not pyogenic; the inflammation it produces runs to granulation tissue. If true suppuration occurs, it is due to a secondary infection. Many are the occasions I have interested my house-surgeon in the spontaneous disappearance of a large spinal abscess. Efficient fixation undoubtedly lessens the liability to their formation and facilitates their disappearance. In a well-immobilised spine quite a large proportion of these abscesses disappear. Writers who do not observe it do not wait sufficiently long. In the hip they are very apt to become nomadic; they change from residence within

the joint to residence without. They become extra-articular, in the sense of having no connection with the joint. Often I have noticed collections, having appeared from the joint, travel down the thigh, become isolated, and then gradually dwindle away. The process of absorption is not characterised by any clinical manifestation. I do not open tuberculous abscesses, not because I dislike a radical operation, but because an operation is necessarily incomplete and ineffective if it cannot remove the disease of which the abscess is but a symptom. If opening the abscess meant eradication of the disease, the problem would be solved.

In a number of cases the abscess is not absorbed, but invades the skin. The longer such abscess is kept back the better for our patient. Abscess which forms early in tuberculous disease and is evacuated is, in my opinion, a more serious affair than the abscess which is treated in the later stage. When the skin reddens I make a small puncture, half an inch in length, or less, using the strictest precautions, scrupulously avoiding the Volkmann's spoon or irrigator, for I do nothing to interfere with the thick sac wall which provides so admirable a barrier against infection. If these abscesses be attacked in this way, the terrors of infection are assuredly much minimised, for a delay of many months in opening the abscess has given the hip or spine time to make progress, the supply of débris is shut off, and the long exhausting discharge which follows early incision is curtailed. I have no conviction more settled in my mind than that of the value of a conservative attitude towards tuberculous abscess. When we remember that hospital surgeons, with all the facilities for the practice of a rigid asepsis, see only an infinitesimal proportion of these cases, and that the overwhelming number are in the hands of practitioners in slums and country places, handicapped by their environments, totally unable to insist on surgical cleanliness, the policy I advocate seems to me of great importance. My experience warrants me in saying that hundreds of children die in all parts of England because we do not realise the many responsibilities involved in the routine opening of tuberculous abscesses.

If, however, with the presence of fluid, discomfort, pain, and temperature are present; if the patient rapidly or steadily declines in condition—then I think the abscess may be suspected and attacked by good incision, bone searched for, and antiseptic irrigation adopted. Here there will be found a mixed infection, and surgical interference is urgent and is most effective when most radical.

It is of course necessary at times to open an abscess because of its geographical site. I have periodically operated and sometimes opened collections in the buttock, loin, or thigh, which from their position prevented the application of a splint. A retro-pharyngeal abscess demands immediate incision, prefer-

ably behind the sterno-mastoid. Evacuation is also needed in those rare instances where one finds spasmodic attacks of dyspnoea, and this is best done by costo-transversectomy over the articulation involved.

The dressing of abscesses amongst the poor is a great consideration, and I find nothing simpler or more effective than pitch-pine sawdust, soaked in mercuric chloride. It does not cost a penny a pound, and can be prepared by any practitioner in a remote village. It can be kept upon an abscess before it opens, so that, if evacuation occurs spontaneously, the contents will be received into a sterile medium; and if carefully instructed, the intelligent poor, aided by boiled spoons, can themselves conduct the dressings. Such cases amongst the poor, out all day in the open, lying on a spinal carriage or a rug, do infinitely better than in the best equipped hospital wards. For years I have refused admission, into the Royal Southern, of all tuberculous cases for longer than is needed to correct deformity. Tubercle flourishes in city hospitals. Happily we have inaugurated in Liverpool a great scheme whereby this year we build on the banks of the Dee, facing the Welsh mountains, a country hospital for children, with an ultimate accommodation for 200 beds, no time limit, with every facility for medical and surgical treatment in sunshine and pure air. This is a departure sure to succeed, which should be followed by every large city, for nothing is more distressing to the surgeon than helplessly to watch these children drifting from one institution to another, until their disease ends in crippledom or death.

In the case of the hip the splint is kept on until consolidation of the structures is apparent, all deformity has disappeared, and the pelvis lowered on the diseased side. Abduction should always be aimed for to compensate for shortening, the abducted limb being gradually brought towards the sound side and the double frame changed for a Thomas hip splint. There may still be a sinus discharging, but that need not trouble. Walking should be allowed, aided by patten and crutches, and by degrees, under appropriate supervision, restraints should be removed and tests for recovery from time to time employed. It may be opportune here to refer to the tests for recovery, a subject upon which our textbooks are usually silent. A joint is cured of disease where the range of movement does not diminish by use; and in those cases resulting in ankylosis a joint may be pronounced well where the angle does not change after use.

Let us take the elbow-joint as an example. The little patient has his arm slung up at an acute angle. All pain has gone, the swelling is diminished, and no active symptom is demonstrable. The surgeon ventures, therefore, to drop the arm in the sling 2 or 3 in., and carefully notes the result. If on his next visit, a week later, the patient is able voluntarily to raise his arm to the position from which it was lowered, recovery is assured and

greater liberty may be given. If, on the contrary, the elbow has become stiff in the lowered position, rest has to be prescribed still longer. In the one case the range of movement does not diminish by use, in the other it does. The principle is applicable to all joints. In the case of the hip the most convenient test is that of flexion. If the patient leaves with a flexion angle of 10° , and comes back with one of 15° , then recovery has not taken place.

The hip splint is composed of wrought-iron, which must be sufficiently malleable to admit of being moulded into shape by suitable wrenches, and sufficiently unyielding to prevent any modification in shape by movements, voluntary or accidental, on the part of the patient. Most surgeons give their instrument-makers instructions to make the splint light and narrow, apparently unconscious of the fact that the bed, and not the patient, has to bear its weight. If the splint be made light, the patient usually soon distorts it, and is cured, if at all, in a deformed position, while motion is allowed to a joint which requires uninterrupted rest.

The splint (Fig. 7), which is covered with leather, consists of three wings, A, B, C (Fig. 7), and an upright or stem.

Wings.—The top wings extend two-thirds around the chest, at about the level of the nipples. The second extend two-thirds around the thigh, about an inch or two below the groin.

The leg wings bear similar proportions, and reach lower than the middle of the calf. They should all be much more easily bent than the upright, and the uppermost should terminate in loops, meant for the reception of bandages, which extend from the top of the stem (Fig. 7, D), and round the shoulders.

Upright or stem.—It consists of a body portion, a thigh portion, and a buttock bend. The body portion should be parallel to and longer than the thigh portion. This question of direction is extremely important, as any modification of it will invariably tend to the maintenance of deformity, and often to the production of pain. The incline in the buttock bend is invariable, and, in a case where a trochanter is enormously hypertrophied, it may almost be dispensed with. In that case the body and thigh portions are not merely parallel, but almost complete a straight line.

Measurement.—In measuring for a splint, the distance from the axilla to middle of leg should be stated, with the side affected.

Application.—The buttock bend (Fig. 8, A) should be *in situ* midway between the sacrum and the trochanter major. The body

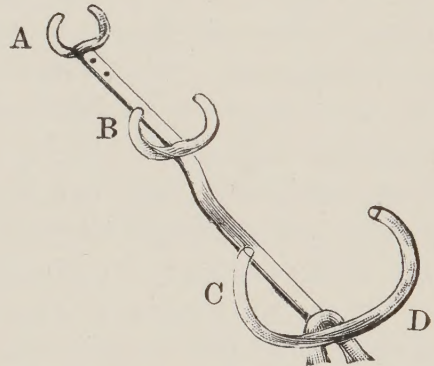


FIG. 7

portion of the stem requires in every case a twist with the wrenches (Fig. 8). This will be readily understood when we

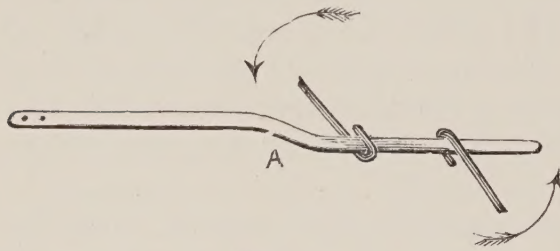


FIG. 8

recollect that it lies to one side of the spine against the chest, which is barrel-shaped, and the ribs are only thinly clad with muscles. If there were no twist, the inner edge of the stem would cause unbearable pain and soreness.

The twist ends at the buttock bend, as the gluteal region is flat and fleshy. Fig. 8 shows the process of twisting a splint intended for the left side. The wings have been dispensed with for convenience of demonstration. Obviously the twist should be just sufficient to permit the chest-wall to lie in juxtaposition to the flat surface of the splint. It is important to remember that, in the majority of cases, there is a strong tendency for the splint to escape to the outer side of the diseased limb, and it is very necessary to counteract it. There are three principal ways of doing this, and in each the wings play their part. It is necessary to adopt a combination of the three methods rather than trust to any one. The methods are: (a) Making room for the body in a direction calculated to keep the splint towards the spine; (b) fixations of the inner wings; (c) special bandaging.

These preventives are fortified by another very simple expedient, which consists in making a small hole in the bandage and passing through it the outer of the thigh wings, and rolling it under the thigh and round the limb, so that a pull is instituted upon the appliance in the direction opposite to its tendency to escape.

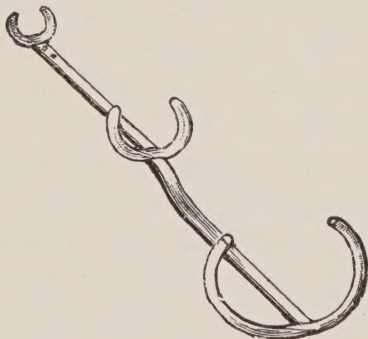


FIG. 9.—Incorrect model

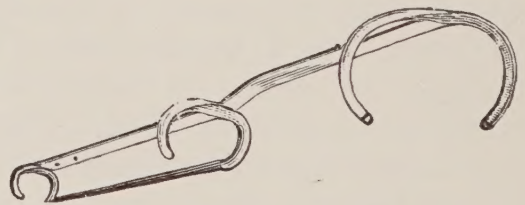


FIG. 10

These three methods in combination render outward displacement impossible. And now is a favourable time to draw attention to the correct and incorrect methods of bending the body wings. As the chest is not quite circular, it is necessary that the body wings should not be made circular, else, in addition to grievous mechanical blunders, much soreness may result. The part upon which the patient lies is but very slightly curved, and this allows

the body to travel easily towards the outer side, which has been shown to be a mechanical necessity. Fig. 7, which is correctly modelled, may be compared with the diagram Fig. 9, which represents the almost circular incorrect body wings.

Where there is a tendency to abduction, combined with genu valgum—Fig. 10 displays a small bar of iron fixed from the tip of the outer thigh wing to that of the calf—the knock-knee can be bandaged to the outside bar, and the deformity gradually accommodated.

But we frequently have to combat a deformity requiring more watching than abduction, and that is adduction, where the body forms a concavity to the inner side of the stem, and where, in advanced cases, the stem lies altogether to the outside of the body. Fig. 11, which is a right splint, illustrates the manner of meeting this complication. The body wing to the inside of the disease is drawn well down, and pressed firmly against the body convexity, in order to get leverage upon the spine sufficiently low not to be counteracted by the mobile character of the vertebral column. Sometimes, with the same end in view, an additional wing is fixed, shown in dotted lines on Fig. 11. The outside body wing, to enhance the effect of its opposite, is drawn upwards to allow the body to return into normal shape.

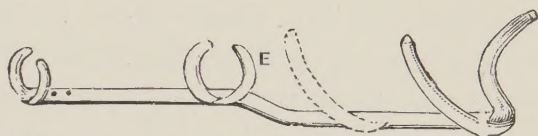


FIG. 11

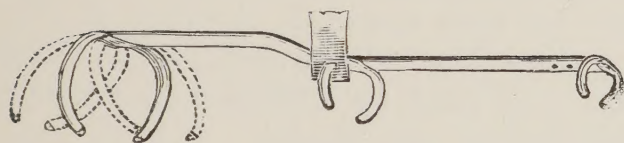


FIG. 12

towards the neck. The dotted lines (Fig. 12) will illustrate this.

The most common errors result from making splints too light, and the following practical instructions may be useful :

For an adult of about 6 ft., the upright should measure $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. For an adult of about 5 ft. 6 in., the upright should measure $1\frac{1}{8}$ in. by $\frac{1}{4}$ in. For a youth or woman, the upright should measure $1\frac{1}{8}$ in. by $\frac{3}{16}$ in. For a boy of 10, the upright should measure $\frac{3}{4}$ in. by $\frac{3}{16}$ in. For a child of 5, the upright should measure $\frac{1}{2}$ in. by $\frac{1}{8}$ in. For an infant of 2, the upright should measure $\frac{1}{2}$ in. by $\frac{3}{16}$ in. The wings should be the same width and about one-third of the thickness of the upright.

The treatment of bony and fibrous ankylosis has constantly to be undertaken by the surgeon. If the ankylosis be sound, the

task is easy, for so soon as the limb is straightened the trouble ends. By a sound ankylosis I mean an ankylosis which does not alter by use; an unsound ankylosis tends to increasing deformity, so that when mechanical or operative procedures have been adopted, recurrences have to be guarded against for varying periods. Although many joints recover movement, I prefer an ankylosis to occur in severe cases, especially in the hip, knee, and ankle. A firmly fixed joint is less subject to strain, and recurrence of disease is not likely to take place. In a bad tuberculosis the result aimed at is an ankylosed joint in good position, and an operation for pseudo-arthritis is not called for. Not so, however, if both hips are involved. Let us take, as an example, the case of a youth of 16, the victim of double coxitis resulting in double ankylosis with flexions and adductions. Walking consists in a rotatory movement of the body with advances in semicircles; or the patient will swing on crutches. In such a case I look for the side where the trochanter is highest above Nelaton. I saw through the trochanter on that side and overcome the flexion, divide the adductors if necessary, rotate the limb outwards, and place it well abducted. On the opposite side I make an outer incision, clear the bone, and either remove the head and neck, and part of the trochanter, or by means of Gigli's saw and chisel take a piece out of the femur at its upper end. To prevent union, one can affix upon the cut surface of the lower end of the femur some metal foil or celluloid film, or, better still, a screen of soft tissue, which the exposed structures will supply. The second limb is now extended and abducted. On the side where osteotomy has been performed, the fixation to be maintained for six or eight weeks; on the side where bone has been exsected, the limb should daily be moved once in every direction. Passive movements in this early stage are a mistake, and tend to irritate and stiffen; they should be postponed for five or six weeks. I have now operated upon a number of such cases, with gratifying results. During walking the ankylosed limb is unsupported; but the exsected limb is placed in a calliper splint, and soon the patient moves about quite well. Such operations are not confined to children; I have often operated upon men and women of 30 or thereabouts. In children, one is careful, for obvious reasons, to sacrifice as little bone as necessary. Generally speaking, the problem of deformity is confined to one hip, where shortening of from 2 to 5 in. may be present. I have operated upon over 200 such youths, and can speak with enthusiasm of results. Many osteotomies, as we know, have been devised for the correction of a flexion deformity. Perhaps the most popular operation to-day is that of Gant, the division being below the lesser trochanter. Although something must be said in favour of a section which cannot be interfered with by a shortened psoas and iliacus, yet I have found that in cases of right-angled deformity of the hip

the upper part of the femur, left fixed after Gant's incision, has an ugly way of encroaching upon Scarpa's triangle.

With a view of not merely rectifying a flexion angle which has been the general object of a femoral osteotomy, but with the intention of lessening or obliterating adduction with pelvic tilting, I make my incision obliquely through the great trochanter (Fig. 13). This often involves hard work because of the thickening and the sclerosed condition of the bone. To lessen my labour I have added a small knob to the end of an Adams saw (Fig. 14). One can use more energy when there is no danger of transfixing tissues or dislodging the instrument. Where practicable, it is better to saw completely through the bone than only partially. One

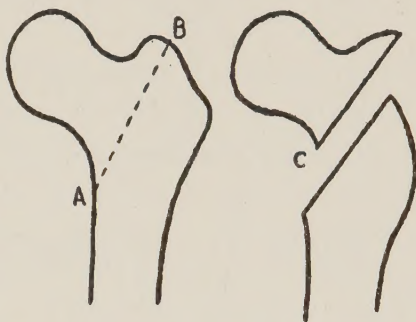


FIG. 13.—A, B, line of section through trochanter; c, lengthening after traction

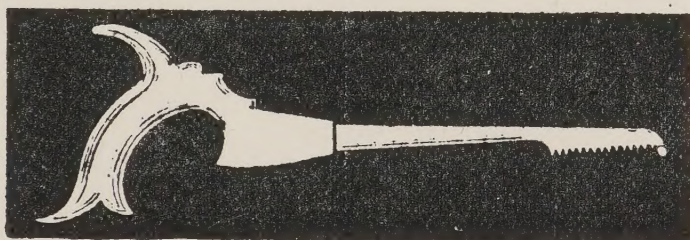


FIG. 14.—Small knob on end of saw to facilitate work

word of warning I may offer to those of limited experience in osteotomies of the upper femur. Deformities are so diverse that

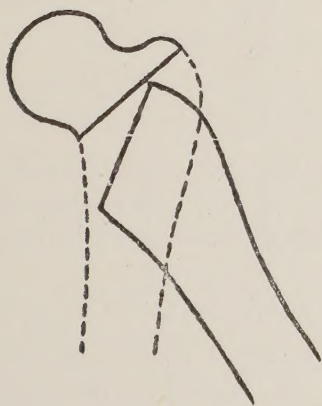


FIG. 15.—Position of fragments when limb is abducted

great care is needed as to the direction of bony incision, for it is easy, unless one is very thoughtful, to introduce the saw into the pelvis. Make your incision through bone parallel to Poupart's ligament, and all danger is avoided. The adductors are now divided, and in a big boy traction is applied by means of pulleys. Very often a little may be gained by this direct traction. The leg, still fully extended, is placed in an abducted position, and both the extension and abduction are maintained (Fig. 15). Union is completed with the leg abducted.

The limbs will now be equalised in two ways: by lessening.

the practical length of the sound limb and increasing that of the short one. By osteotomy and extension the leg is actually lengthened, and by the osseous union of the femur in abduction

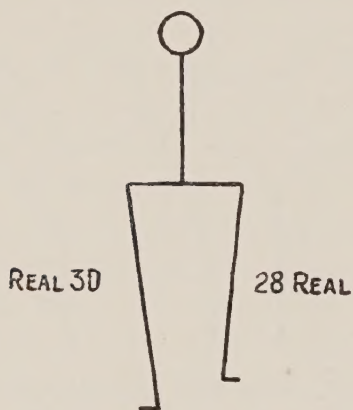


FIG. 16.—Showing 2 in. real shortening

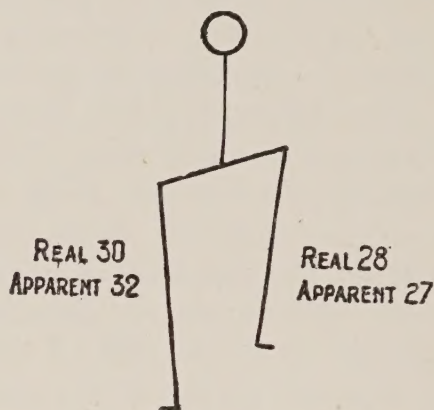


FIG. 17.—Showing real and practical shortening from pelvic obliquity

the elevation of the pelvis on the opposite side is controlled. With an outstretched thigh in one piece with the trunk, the limb can only be adducted by elevating the pelvis on the sound side, and in this way several inches of shortening may be remedied (Figs. 16, 17, 16A, 17A, 18, 19, and 20).

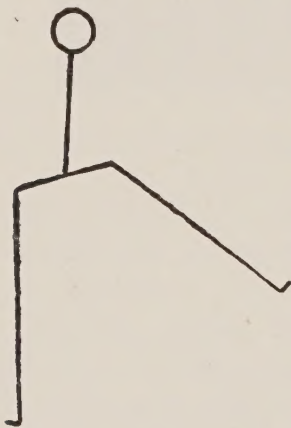


FIG. 16A.—Position of leg after trans-trochanteric osteotomy

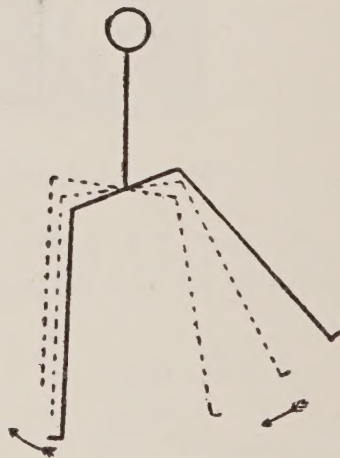


FIG. 17A.—Showing elevation of pelvis on sound side by bringing abducted leg into position

A more difficult class of case to deal with is that where short and firm fibrous union obtains. In such cases I am accustomed to divide the adductors, and extend. If forcible abduction is difficult, I perform osteotomy as if for bony ankylosis. Such cases require to be kept longer in a splint; and if the limb be abducted for a sufficient length of time, say three to four months, further contractions are not likely to occur. We may look upon it as a surgical axiom, that a deformed limb due to arthritis retains the same amount of movement after the deformity is

corrected as it possessed before, and that, if ankylosed at the moment of rectification, it is equally ankylosed when reduction is completed. After the removal of the splint, the patient should be confined to bed until the abducted limb is brought into position, and exercises should be prescribed designed to elevate the pelvis on the sound side.

Active disease of the knee, with marked flexion, is placed in a Thomas knee splint, and can be straightened wholly or in part at once, or by the pressure of a pad. The leverage of combined pad and splint with the added weight of the limb is a much more potent rectifying force than the weight and pulley. Frequently, in neglected cases, we have to combat, in addition to flexion, a subluxation backwards of the tibia. This materially complicates the issue, if we resolve upon mechanical methods, for efforts at reduction often result in more complete displacement of the tibia. If care and time be taken, the deformity may be overcome by placing the patient to lie on his face with the anterior border of the tibia in juxtaposition to the table. The hamstrings, and if necessary the popliteal fascia, are divided, and the thigh extended. In this way the femoral condyles may be levered on to the tibial head; or a genuclast, which, while the knee is at right angles, pushes upon the femoral condyles and pulls upon the tibia, may succeed. It is, however, a most obstinate deformity, and may require a V-shaped excision for its treatment. In the case of children, as I have said before, one scrupulously avoids unnecessary sacrifice of bone, but when in bony ankylosis an exsection is decided on, I take the precaution of making the apex of my V extend only four-fifths through the bone, and with a saw cautiously continue the section after the removal of the wedge. The knee is then acutely flexed, and the posterior aspect of the bone trimmed. All risk of wounding the popliteal vessels is in this way avoided, and if we take care that the flexion is entirely overcome, the after result will be good. If enough bone is not removed some flexion will remain, together with a straining of the popliteal structures which will threaten the vitality of the limb.

It will be agreed that the prevention of deformity is of paramount interest, and it depends largely upon the knowledge and skill of the general practitioner. To him is given the opportunity of seeing these tuberculous lesions in their beginnings, and the course of events is largely influenced for good or evil by the steps



FIG. 18.—Showing final result with abduction of leg and elevation of pelvis of sound side

he takes. It should be clearly stated that, whatever differences of opinion we may hold regarding treatment, given an early case no appreciable deformities of the extremities should result. We can govern flexion, adduction, and rotation of the hip. We can control subluxation of the tibia; this does not admit of question. We can influence, only indirectly, arrest of growth, but we should always strive for the position of greatest utility. This, in the hip, is abduction and full extension; in the knee, extension; in the ankle, an angle of 95° ; in the wrist

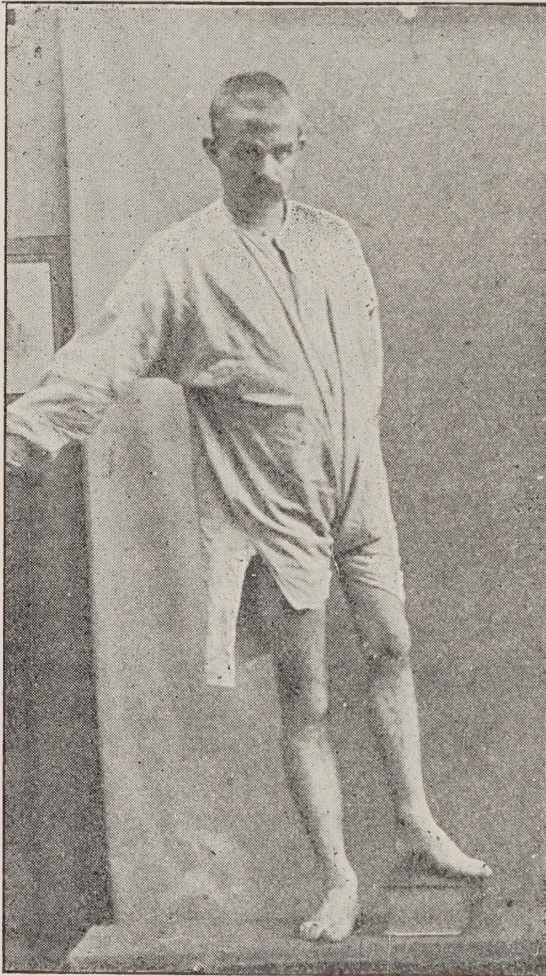


FIG. 19.—5 in. apparent shortening

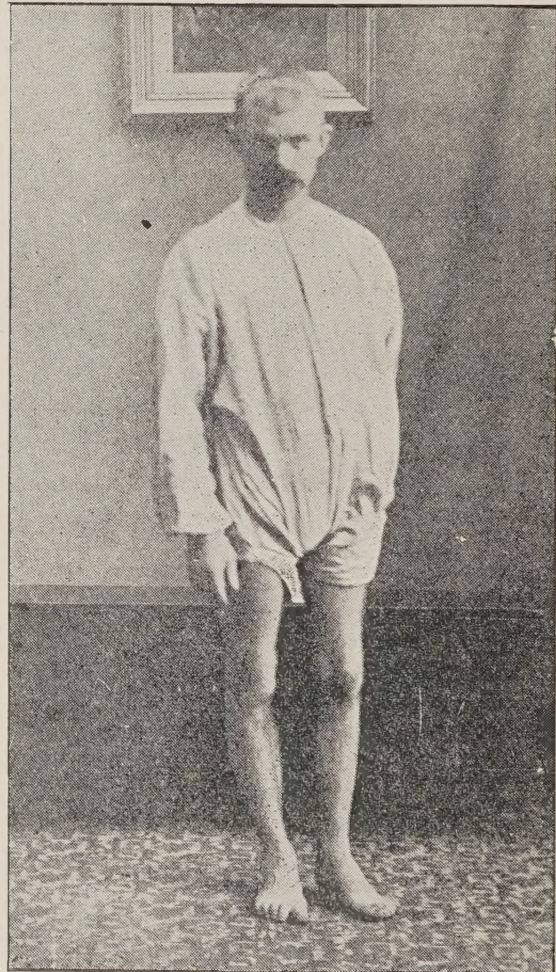


FIG. 20.—Same case rectified

and spine, hyper-extensions; in the elbow, usually an angle of about 40° .

How often we notice the ankle stiffening in a position which prevents the heel from touching the ground. Nothing can be worse. At every step the patient takes, a cross strain is cast upon the weakened joint. Again, the hyper-extended position is of great importance in the treatment of the wrist, and yet invariably it is treated on a straight splint, which results in ankylosis in a flexed position. If one wishes to grip powerfully, the wrist is first instinctively extended. One cannot grip effect-

ively with the wrist flexed. The lesson is obvious. If disease at the wrist results in ankylosis in the extended position, every advantage will accrue to the patient's grip. So true is this that when a patient consults me complaining of faulty use of the fingers, should the wrist be ankylosed in the flexed position I attack the ankylosis by the wrench, and place the wrist in extension with happy effect.

Without entering into controversial matters in the treatment of spinal caries, one may say that, under the best available mechanical means in certain regions, it is difficult to influence curvatures. This is especially the case in the lower cervical and upper dorsal regions. Not so, however, in the dorso-lumbar area. Given an early case, one should fairly efficiently guard against a kyphos. The deformity arises, as we know, from destructive disease on the anterior aspect of the vertebral bodies, and a kyphos is due to a direct falling forward of the bone above the destroyed area. We should, therefore, counteract this by keeping the spine rigidly fixed upon a convex support; if this be done effectively, we need have no apprehensions of a serious deformity. The straight splint should be discarded.

In this address I have endeavoured to treat in a practical way some of the many problems connected with arthritis. I have simply told you what I do, without having time to enter fully into reasons. This is very unfortunate, but it is also inevitable. In so wide a field one can only present bare outlines, and the refinements of diagnosis have to be postponed. What I have said, however, is based upon an exceptional number of cases, and if I have been able to instil a spirit of hopefulness and conservatism into the minds of only a few, I shall be quite content.

May I thank you all for the compliment you have paid me in asking me to Edinburgh, and for your generous and patient hearing?

